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Xianfeng Yuan, Xuemin Li, Xiao Zhang, Yun Li, Lu Liu

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MoS_2 Vertically Grown on Graphene with Efficient Electrocatalytic Activity in Pt-free Dye-Sensitized Solar Cells

Xianfeng Yuan, Xuemin Li, Xiao Zhang, Yun Li, and Lu Liu*

College of Environmental Science and Engineering, Nankai University, Tianjin Key Laboratory of Environmental Remediation and Pollution Control, Tianjin 300071, P.R. China.

E-mail: liul@nankai.edu.cn

Abstract

In this report, MoS_2 nanosheets grown vertically on reduced graphene oxide (MoS_2@RGO) were successfully prepared via a facile hydrothermal process, and then worked as counter electrode (CE) in dye-sensitized solar cells (DSSCs). The MoS_2@RGO materials revealed enhanced electrocatalytic activity and stable chemical property for accelerating the reduction of I^-/I_3^- redox couple. Cyclic voltammograms (CV) showed that the peak current density (J_A) and peak spacing (E_{pp}) of MoS_2@RGO CE were smaller than Pt, MoS_2, and RGO in DSSCs, owing to the superior carrier transfer properties of graphene, abundant catalytic active sites and low resistance of MoS_2@RGO. Furthermore, the power conversion efficiency (PCE) of MoS_2@RGO CE reached 6.82%, which is higher than that of Pt CE (6.44%). Electrical impedance spectroscopy (EIS) and tafel polarization were also investigated to demonstrate positive synergetic effect between MoS_2 and RGO, as well as efficient electrocatalytic perfromance in Pt-free DSSCs.